

The neutralized product is next subjected to hydrolyzing temperatures of 70° F. to 350° F. in order to convert the neutralized product to the desired detergent composition. Fifteen minutes to 72 hrs. at atmospheric pressure up to 120 p.s.i.g. and the above temperatures is sufficient for purposes of this invention. Preferably, the product of the neutralization step is hydrolyzed at a temperature of 200° F. to 300° F. for from 15 min. to 20 min. Preferably a pressure range of from 100 p.s.i.g. to 120 p.s.i.g. is employed in the hydrolyzing step at the above preferred temperature and time conditions. Failure to perform the above hydrolyzing step results in a composition possessing inferior detergency properties.

As a result of the above process, a very excellent detergent composition is obtained. By maintaining the above process conditions a detergent composition of the following formulation is obtained:

(a) From 40% to 55% of a water-soluble salt of alkene-1-sulfonate containing from 10 to 20 carbon atoms wherein the alkene double bond is distributed between the terminal carbon atom having attached thereto the sulfonate radical and the fifth carbon atom;

(b) From 20% to 40% of a water-soluble salt of 2-alkoxy-alkane-1-sulfonate containing from 10 to 20 carbon atoms in the alkane chain and from 1 to 4 carbon atoms in the alkoxy radical;

(c) From 10% to 20% of the water-soluble salts of 3- and 4-hydroxy alkane-1-sulfonate containing from 10 to 20 carbon atoms; and

(d) From 2% to 15% of a water-soluble salt of alkene disulfonate wherein the compound has from 10 to 20 carbon atoms, one sulfonate radical attached to a terminal carbon atom and the other sulfonate group attached to a carbon atom not more than three carbon atoms removed from the said terminal carbon atom and the alkene double bond distributed between said terminal carbon atom and the seventh carbon atom.

Examples of cations that form the water-soluble salts are alkali metals, e.g. sodium and potassium, ammonium and substituted ammonium compounds, e.g. trialkylammonium and trialkylolammonium compounds. Specific examples of substituted ammonium compounds are mono-, di-, tri- and tetraethylammonium, mono-, di-, tri- and tetramethylammonium, and mono-, di-, tri- and tetraethanolammonium.

The following example is illustrative of the process of the invention:

#### Example I

An alpha-olefin having an average carbon chain length of 16 carbon atoms was fed to a film reactor at a rate of 0.49 pound per minute. The film reactor was 6 feet in length and had an inside diameter of about 0.9 inch. Cooling water having an entering temperature of about 43° F. and an exit temperature of about 45° F. was passed through a water jacket surrounding the reactor. A mixture of sulfur trioxide and air (5% sulfur trioxide on a volumetric basis) was passed into the reactor at the rate, on a sulfur trioxide basis, of 0.19 pound per minute. This represented a molar ratio of sulfur trioxide to olefin of about 1.08:1. The pressures at the reactor inlet and outlet were 12.0 p.s.i.g. and 3.8 p.s.i.g., respectively. The residence time of the reactants in the film reactor was about 20 seconds. Approximately 96% of the olefin was sulfonated. The sulfonated mix was dropped directly from the film reactor to a gas/liquid separator to remove excess sulfur trioxide and air. The gas/liquid separator was provided with a quantity of methanol in its lower portion. The elapsed time of the sulfonated mix to go from the film reactor to contact with the methanol was about two seconds. 0.55 pound per minute of methanol was added to the separator-corresponding to a methanol to sulfonated reaction mix ratio of about 8:1 on a molar basis. The resultant mix was allowed to react for about 30 min. at 110° F. Thereafter, the sulfonate-methanol

reaction product was neutralized with NaOH on a molar basis of 1.1 moles of NaOH per mole of reacted sulfonate. The neutralization was carried out at a temperature of about 144° F. The neutralized product was next sent to a hydrolyzer where under conditions of a temperature of 230° F. a pressure of 112 p.s.i.g., and a time of 17 minutes, a paste was obtained that contained the detergent composition of this invention. The paste of this process contained about 33.5% by weight detergent composition. This detergent composition when analyzed contained on a weight basis about 48% sodium hexadecene-1-sulfonate, 34% sodium 2-methoxy-hexadecane-1-sulfonate, 11% sodium 3- and 4-hydroxy hexadecane-1-sulfonate, about 5% sodium hexadecene disulfonate, and the balance comprising sodium sulfate and sodium methyl sulfate.

#### Example II

The process of Example I was repeated with the exception being that (1) the sulfonation was carried out in a nine foot film reactor having a pressure at the top and bottom of the reactor of 8 p.s.i.g. and 0 p.s.i.g., respectively and a time of reaction of about 28 seconds and (2) the hydrolysis was conducted at atmospheric pressure for about 2 hours at about 150° F. Approximately 87% of the olefins were converted. The final composition contained about 50% sodium hexadecene-1-sulfonate, 23% sodium 2-methoxy hexadecane-1-sulfonate, 19% sodium 3- and 4-hydroxy hexadecane-1-sulfonate, 6% sodium hexadecene disulfonate and the balance comprising sodium sulfate and sodium methyl sulfate.

#### Example III

Example I was repeated with the exception that reaction temperatures of 100° F. and 70° F. were used in the sulfonation and methanol reactions, respectively. About 97% of the olefins were sulfonated. The final composition contained about 51% sodium hexadecene-1-sulfonate, 26% sodium 2-methoxy hexadecane-1-sulfonate, 18% sodium 3- and 4-hydroxy hexadecane-1-sulfonate, 3% sodium hexadecene disulfonate and the balance comprising sodium sulfonate and sodium methyl sulfate.

#### Example IV

Example I was repeated except for carrying out the sulfonation reaction at 140° F. and the methanol reaction at 70° F. Approximately 96% of the olefins were sulfonated. The composition of the final product was as follows: 47% sodium hexadecene-1-sulfonate, 35% sodium 2-methoxy hexadecane-1-sulfonate, 15% sodium 3- and 4-hydroxy hexadecane-1-sulfonate, 2% sodium hexadecene disulfonate, and the balance sodium sulfate and sodium methyl sulfate.

#### Example V

The process of Example IV was repeated except for using a methanol reaction of 32° F. The final composition contained 47% sodium hexadecene-1-sulfonate, 37% sodium 2-methoxy hexadecane-1-sulfonate, 13% sodium 3- and 4-hydroxy hexadecane-1-sulfonate, 2% sodium hexadecene disulfonate, and the balance sodium sulfate and sodium methyl sulfate.

#### Example VI

When Example I was repeated increasing the sulfur trioxide to olefin ratio to 1.22 to 1 and keeping the other parameters constant, the following detergent composition was obtained: about 46% sodium hexadecene-1-sulfonate; about 26% sodium 2-methoxy hexadecane-1-sulfonate; about 16% sodium 3- and 4-hydroxy hexadecane-1-sulfonate; about 11% sodium hexadecene disulfonate; and the balance comprising minor impurities.

#### Example VII

An alpha-olefin having an average carbon chain length of 12.8 carbon atoms was sulfonated in essentially the same manner as the olefin of Example I. The difference in